Chapter 15

PUMP, DE-ICING, T.K.S., TYPE XA9500 SERIES

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Introduction

1. The XA 9500 series de-icing pump comprises a horizontally opposed pump unit driven, through gearing, by an electric motor. This unit is designed to pump the de-icing fluid from the storage tank througout the de-icing system..

DESCRIPTION

Motor

2. The motor is a 28V d.c. two-pole continuously rated machine, giving an output of 0·06 h.p. at 6000 rev/min. A radio interference suppression capacitor is fitted across the terminal block.

Pump unit

3. The pump consists of a pump body machined from a light alloy casting comprising filter chamber and gear casing. Fitted in this are the inlet filters, camshaft and either one or two micro pump assemblies each of three units.

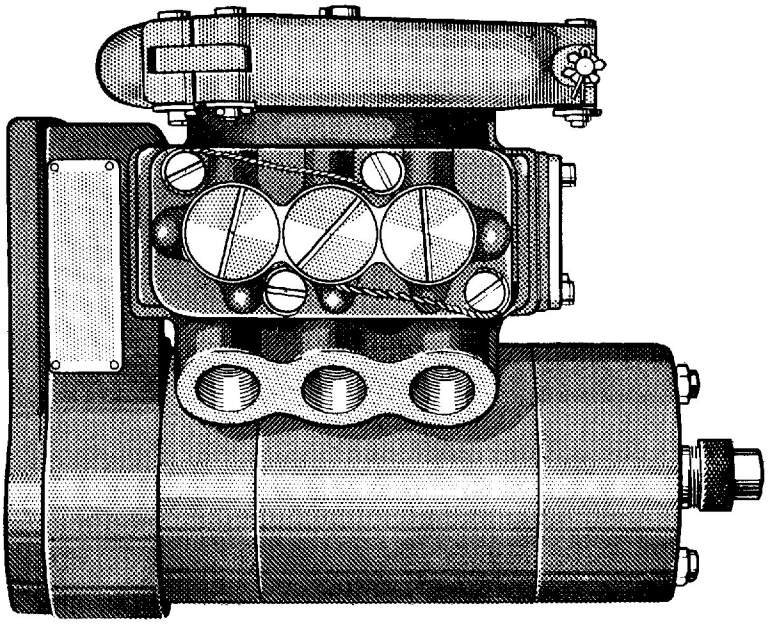

Fig. 1. Typical de-icing pump, T.K.S., Type XA9500 series

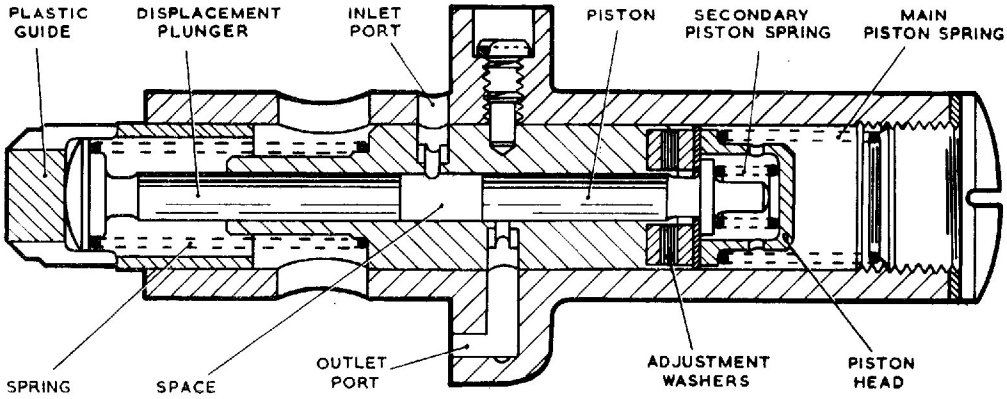

Fig. 2. Section view of micro pump unit

4. The filter chamber is situated immediately above the camshaft on the top of the pump body. The filter assembly is built up from three filter discs fitted to a spindle, the whole assembly being screwed into the base of the filter chamber. The filter chamber and pump are completely flooded with de-icing fluid which also serves as a lubricant for the moving parts. The pump gear case is filled to the level of the filler plug with hydraulic oil (Ref. No. 34B/9100553).

5. Each assembly of micro pump units is attached to a machined face on the side of the pump body and each pump unit is capable of giving a maximum delivery of 22 pints per hour.

Operation

6. The plastic guide of the displacement plunger bears on the driving cam by which it is reciprocated through a constant stroke regardless of any adjustment of output. A

spring serves to keep the plunger in contact with the underside of the plastic guide, the top of which is kept in contact with the cam.

7. Towards the bottom of the stroke the plunger uncovers the inlet port permitting the entry of fluid. After the first third of its return stroke the port is completely masked, trapping a volume of fluid in the space between the plunger and piston. Movement of the plunger carries the fluid outwards against the resistance of the secondary piston spring until the outer end of the piston contacts the piston head. The main piston spring is then compressed until the piston partially uncovers the outlet port through which the fluid is discharged. As the cam revolves the plunger and piston will return to the position shown in fig. 2 under the influence of their respective springs. The volume of fluid trapped controls the output of the pump and can be varied between zero and maximum by altering the limiting position of the piston at the bottom of its stroke.

SERVICING

8. Examine the pump for external damage and signs of corrosion and leakage. If it is required to renew any of the components the pump should be dismantled as detailed in the following paragraphs. During dismantling reference should be made to fig. 3 and fig. 4 as appropriate.

Dismantling

9. Before dismantling the pump proceed as follows:—

(1) Remove the gear casing filler plug 29 and drain the oil.

(2) Unscrew the pump filter from the housing in top of the pump. Turn the whole pump upside down and drain all the de-icing fluid from the pump body. The XA 9501 pump can be drained by removing the drain plug 46 in the blanking plate 48.

Pump

10. To dismantle the de-icing pump:—

(1) Remove the seven screws securing the gear case cover 24 and remove the cover and gasket.

(2) Remove the four screws and washers securing the motor 50 to the gear case housing and remove the motor.

(3) Unscrew the screws which secure the micro pump assemblies to the pump body and remove the micro pump assemblies. In the XA 9501 pump the blanking plate should be removed.

(4) Remove the nut and tabwasher securing the pump gear wheel 22 and remove the gear wheel.

(5) Remove the four screws securing the camshaft bearing housing 1 and laminated joint 3 and remove the housing and joint. Care must be taken not to damage the laminated joint.

(6) Withdraw the camshaft 4 through the hole from which the bearing housing was taken.

(7) Extract the Gitseal 21.

11. To dismantle the filter previously removed, unscrew the knurled ring 13 from the centre bolt 6 and remove the metal washer, rubber washers and elements.

12. To dismantle the micro pump assemblies:—

Note . . .

Ensure that the parts of the micro pump are identified so that they are replaced in the unit from which they were removed.

(1) Remove the plug 41 and fibre washer 42, then withdraw the piston main spring 40, piston head 43 and piston secondary spring 44.

(2) Remove the piston 39, retaining washer 38, brass washers 45 and shims 37.

(3) Remove plunger cap 30, plunger 31 and plunger spring 32.

(4) If it is required to remove the liner 33, remove the locking screw, which is peened in position, from the top of the flange.

Motor

13. Remove the motor from the pump para. 10 (1) and (2) then proceed as follows:—

(1) Remove the cable gland components items 15 to 18.

(2) Remove the two nuts and washers securing the commutator end cover 14 and remove the cover.

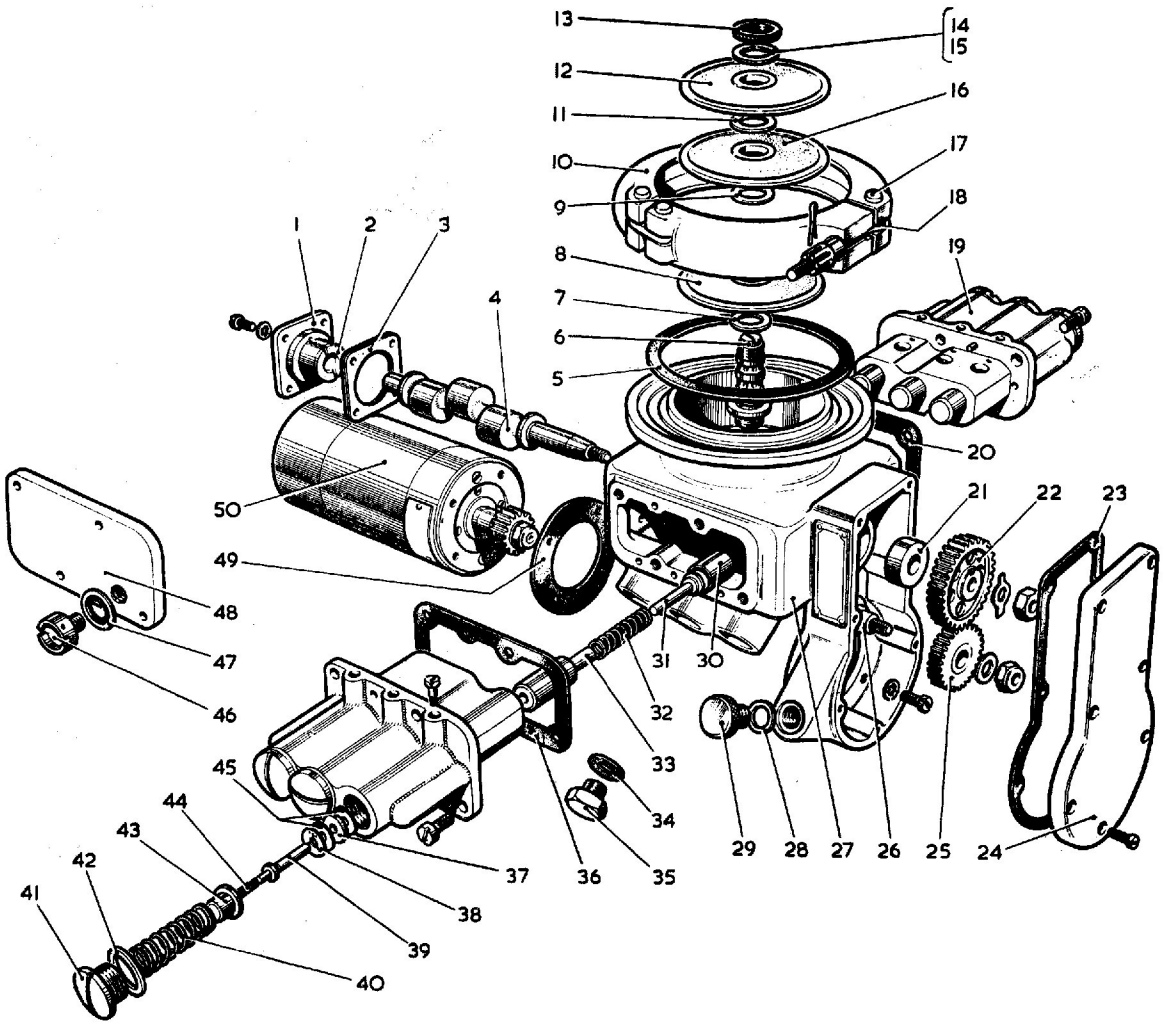

Fig. 3. Exploded view of pump

(3) Remove the brush retaining split pins and withdraw the brushes 2.

(4) Remove the terminal block screws and lift off the capacitor 12.

(5) Remove the nuts and washers securing the commutator end frame 4 and withdraw the two long bolts and washers.

(6) Remove the two commutator end bearing screws and washers and lift off the outer bearing cover 9, inner bearing cover 8 and bearing loading spring 7.

(7) Withdraw the drive end frame 26 and armature assembly 20 from the commutator end frame and field assembly.

(8) Remove the bearing 6 and oil thrower 19.

(9) Remove the shaft nut, washer, gear wheel 30, Woodruff key 21, washers 27, collar 29 and oil thrower 28.

(10) Remove drive end frame 26 from armature assembly.

(11) Remove the eight screws securing the bearing retainers 22, remove the retainers and gaskets and press out bearing 25.

(12) Withdraw the commutator end frame 4 from the yoke 1 as far as the connections permit.

(13) Remove the screws and nuts securing the brush gear assembly 3 to the commutator end frame 4 and remove the commutator end frame.

KEY TO FIG 3

1 HOUSING, BEARING BUSH
2 BUSH, BEARING
3 JOINT, LAMINATED
4 CAMSHAFT
5 RING, JOINT
6 BOLT, FILTER CENTRE
7 WASHER, RUBBER
8 ELEMENT, DISC, FILTER
9 WASHER, RUBBER
10 CLAMP RING ASSEMBLY
11 WASHER, RUBBER
12 ELEMENT, DISC, FILTER
13 RING, KNURLED
14 WASHER, BRASS
15 WASHER, RUBBER
16 ELEMENT, DISC, FILTER
17 PIN, CLEVIS
18 BOLT, EYE, CLAMP RING
19 HOUSING, MICRO PUMP ASSEMBLY
20 GASKET, MICRO PUMP ASSEMBLY
21 GITSEAL
22 GEAR WHEEL, PUMP
23 GASKET, GEAR BOX COVER
24 COVER, GEAR BOX
25 GEAR WHEEL, IDLER
26 STUD
27 PUMP BODY
28 WASHER, SEALING
29 PLUG, GEAR BOX FILLER
30 CAP, PLUNGER
31 PLUNGER
32 SPRING, PLUNGER
33 LINER
34 WASHER, FIBRE
35 PLUG, BLANKING
36 GASKET, MICRO PUMP ASSEMBLY
37 WASHER, SHIM ADJUSTER
38 WASHER, RETAINING
39 PISTON
40 SPRING, PISTON, MAIN
41 PLUG
42 WASHER
43 HEAD, PISTON
44 SPRING, PISTON, SECONDARY
45 WASHERS
46 PLUG, DRAIN
47 WASHER, BONDED SEAL
48 BLANKING PLATE
49 WASHER, MOTOR SEALING
50 MOTOR

Assembling

Pump

14. (1) If the idler gear 25 and stud 26 have been removed from the pump body 27, screw in the stud locking it with a tabwasher. Assemble the idler gear to the stud and secure with a nut and washer.

(2) Insert the camshaft 4 through the bearing housing hole guiding the tapered journal of the camshaft through the bearing bush in the wall of the gear case.

(3) Place the laminated joint 3 into position on the bearing housing 1 and secure the bearing housing with four screws and lock washers..

(4) Check the end play between the flange of the camshaft journal and the face of the bearing bush 2 in the housing, min. 0·003 in., max. 0·010 in.

(5) Place Gitseal 21 with the flat side facing outwards in position over the tapered end of the camshaft journal and gently press it into its housing. Care should be taken not to damage the delicate lip.

(6) Fit the pump gear wheel 22 on the camshaft and secure using a tabwasher and $\frac{1}{4}$ in B.S.F. nut.

(7) Assemble the filter assembly by placing a rubber washer over the centre bolt 6 followed alternately by an element and rubber washer. A metal washer must be placed on top of the rubber washer before the nut 13 is replaced.

(8) Fit the filter assembly in its housing, tighten fully and wire-lock.

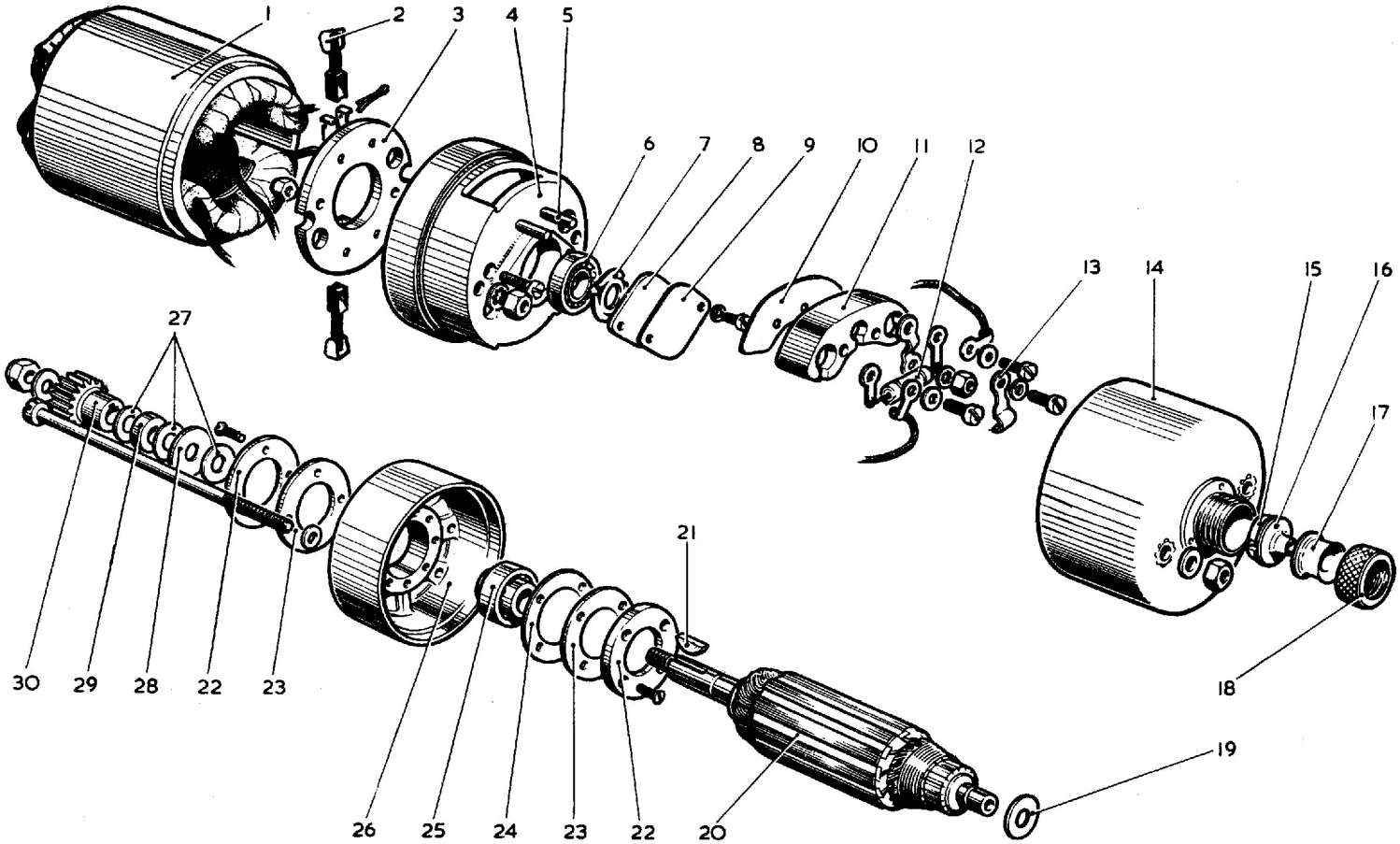

Fig. 4. Exploded view of motor

KEY TO FIG 4

1 FIELD ASSEMBLY
2 BRUSH
3 BRUSH GEAR ASSEMBLY
4 COMMUTATOR END FRAME
5 RIVET
6 BEARING, COMMUTATOR END
7 SPRING, BEARING LOADING
8 BEARING COVER (METAL)
9 BEARING COVER (TUFNOL INSULATION)
10 INSULATOR
11 TERMINAL BLOCK
12 CAPACITOR
13 CLIP, CAPACITOR
14 END COVER ASSEMBLY
15 COLLET
16 SLEEVE, INNER
17 SLEEVE, OUTER
18 NUT, GLAND
19 THROWER, OIL
20 ARMATURE
21 KEY, WOODRUFF
22 RETAINER, BEARING
23 GASKET, OAKENSTRONG
24 GASKET, RUBBER
25 BEARING, DRIVE END FRAME
26 DRIVE END FRAME
27 WASHER
28 THROWER, OIL
29 COLLAR
30 GEAR WHEEL

15. To assemble the micro pump assemblies:—

(1) If micro pump liner 33 has been removed, insert liner and line up with the inlet and outlet ports.

(2) If new liner, drill hole $\frac{1}{8}$ in. deep using No. 34 drill, passing the drill down the locking hole in the micro pump housing.

(3) Secure liner with screw and peen metal into screwdriver slot to lock screw.

(4) Assemble the plunger spring 32 over the plunger 31 and insert into liner. Ensure that this is the same liner from which the plunger was taken.

(5) Place plunger cap 30 over the head of the plunger and into the bore of the housing.

(6) Sandwich the shim adjustment washers 37 between brass washers and place, with securing washer 38, under the head of the piston 39 before inserting the piston into the upper end of the liner. Ensure that this piston was taken from this liner.

(7) Place the piston secondary spring 44 over the upper end of the piston followed by the piston head 43 and piston main spring 40.

(8) Secure in position by fibre washer 42 and plug 41.

16. To replace micro pump assembly on to pump body:—

(1) Place synthetic rubber gasket 36 on the face of the pump body and locate on the dowels.

(2) Place the micro pump assembly in position, locating with the dowel pins, with the numbers stamped on the housing on the upper side.

(3) Secure with four screws and wire lock.

17. To fit motor to pump body:—

(1) Secure the motor with four screws and washers.

(2) Check the backlash between the motor pinion and idler gear wheel and between idler gear wheel and pump gear wheel. A backlash of not more than 0·010 in. should be obtained.

(3) Clean the face of the gear case and cover 24 and smear both faces with Hermeticol or equivalent jointing compound.

(4) Refit the gasket and cover and secure with seven screws.

(5) Fill the gear case to the level of the filler orifice with hydraulic oil (Ref. No. 34B/9100553).

Motor

18. (1) Assemble a gasket 23 and flat bearing retainer 22 to the outside of the drive end frame 26 and secure with four screws.

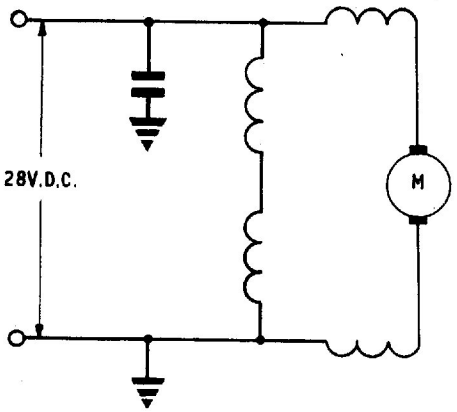

Fig. 5. Circuit diagram

(2) Press in bearing 25 and fit gasket 23, rubber gasket 24 and bearing retainer 22 to inside of drive end frame.

(3) Fit the oil thrower 19 to the armature shaft at the commutator end and press on bearing 6 with shielded face towards the commutator.

(4)Lubricate bearings with grease Ref. No. 34B/9100512).

(5) Fit the drive end frame to the armature shaft.

(6) Refit washers 27, oil thrower 28, collar 29, Woodruff key 21, gear wheel 30 and secure in position with nut and washer.

(7) Smear mating surfaces of spigot on drive end frame and field yoke assembly with grease (Ref. No. 34B/9100512).

(8) Assemble brush gear assembly 3 to commutator end frame 4 and secure with screws.

(9) Smear mating surfaces of spigot on the commutator end frame and field yoke assembly with grease (Ref. No. 34B/9100512).

(10) Fit the commutator end frame 4 to the field assembly, threading the field leads through their respective holes in the brush gear and commutator end frame assembly.

(11) Insert the armature through the field yoke assembly locating the field yoke on the drive end frame.

(12) Refit the earthing strip ensuring that the point of contact with the commutator end frame is cleaned and treated with a film of petroleum jelly.

(13) Insert the two long bolts, with washers, in the drive end frame after ensuring that the faces of the washers are painted with Hermeticol or equivalent jointing compound.

(14) Secure the earthing strip and commutator end frame with washers and nuts.

(15) Refit the bearing loading spring 7, inner bearing cover 9 and secure them with washers and screws.

(16) Refit capacitor 12 and secure it with clip 13, washer and screw.

(17) Secure leads in terminal block using washers and screws.

(18) Fit brushes 2 in brush holders and secure with split pins.

(19) Refit commutator end cover 14 and secure with washers and nuts.

Testing

19. The pump should be fitted to a suitable test rig, similar to that shown in fig. 6 and tested in accordance with the procedure set out in the appropriate appendix.

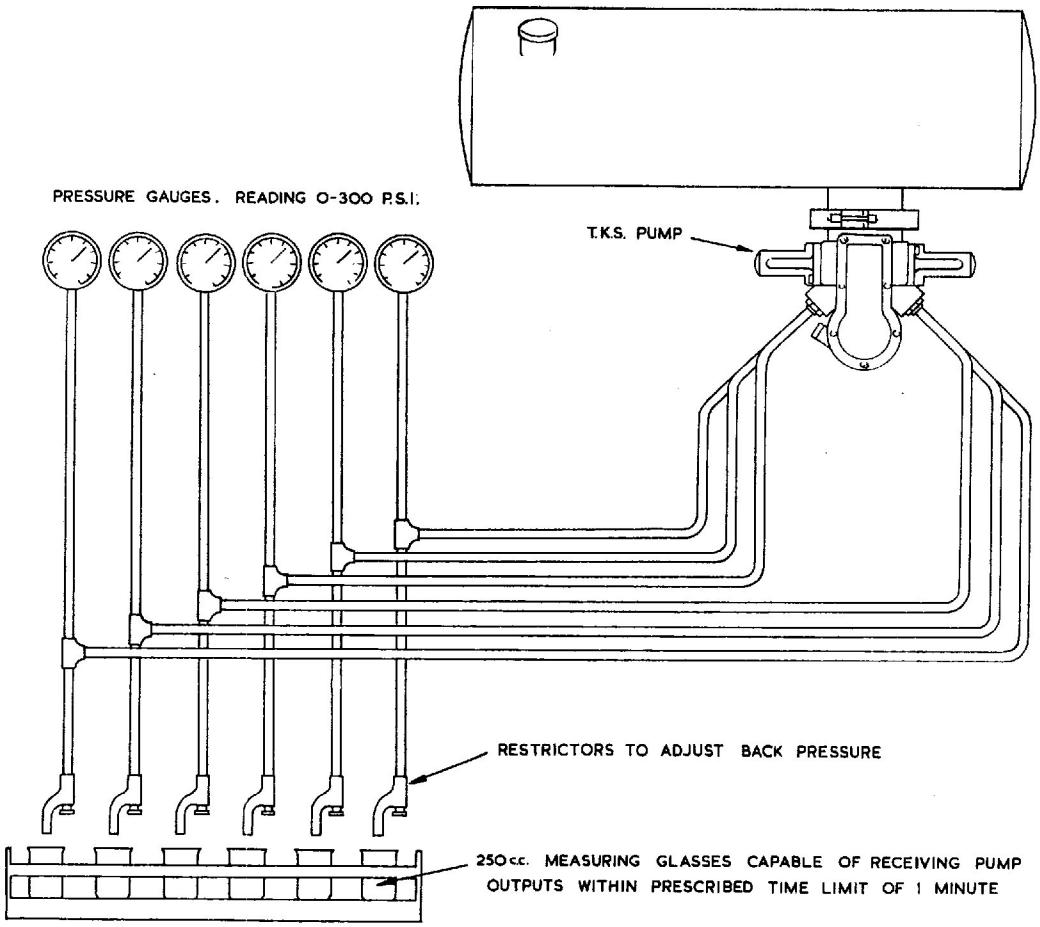

Fig. 6. Test rig for T.K.S. de-icing pump Type XA9500 series

Appendix 1

PUMP, DE-ICING, T.K.S., TYPE XA9500/120

LEADING PARTICULARS

Pump, de-icing, T.K.S., Type XA9500/120	*Ref. No. 5UE/6216*
Number of micro pump units	6
Current consumption (at rated voltage/output)	5*A* (*max.*)
Voltage	28*V*
Shunt field resistance	150-180 *ohm.*
Series field resistance	0·31-0·37 *ohm.*
Minimum commutator diameter	0·6875 *in.*
Maximum eccentricity	0·001 *in.*
Mica undercut	0·02-0·03 *in.*
Minimum brush length	$\frac{7}{32}$ *in.*
Brush spring pressure	2·5 *oz.*

Introduction

1. The de-icing pump Type XA9500/120 is identical to that described in the main chapter.

Testing

Calibration check

2. Connect the pump to a suitable test rig as shown in fig. 6 of the main chapter and fill the tank with oil DTD 900/4598 or DTD 900/4456. Set the back pressure to 50 lb/in^2 and check the delivery over a period of one minute. The following delivery rate should be obtained within the tolerance of $^{+10}_{-0}$ cc/min.

To increase the pump delivery add shims under the piston head. To decrease delivery remove shims.

Note . . .

The calibration oil should be drained before the pump is put into service.

Insulation resistance

3. Remove the commutator end cover, disconnect the capacitor and earthed connection. Test the field coil insulation resistance using a a 250V insulation resistance tester. A reading of not less than 50000 ohms should be obtained.

TABLE 1

Delivery rate

Outlet	1	2	3	4	5	6
Delivery cc/min.	156	167	172	172	Blanked off	Blanked off
Feed to	Fins	Tailplane	Port wing	Stbd. wing		

Appendix 2

PUMP, DE-ICING, T.K.S., TYPE XA9501/102

LEADING PARTICULARS

Pump, de-icing, T.K.S., Type XA9501/102	*Ref. No. 5UE/7866*
Number of micro pump units	3
Current consumption (at rated voltage/output)	*5A (max.)*
Voltage	*28V*
Minimum commutator diameter	0·6875 *in.*
Maximum eccentricity	0·001 *in.*
Mica undercut	0·02-0·03 *in.*
Minimum brush length	$\frac{7}{32}$ *in.*
Brush spring pressure	2·5 *oz.*
Shunt field resistance	150-180 *ohm*
Series field resistance	0·31-0·37 *ohm*

Introduction

1. The de-icing pump Type XA9501/102 is similar to that described in the main chapter. In this pump one of the micro pump assemblies is replaced by a blanking plate. A drain plug is screwed in this blanking plate through which the pump body can be drained.

2. The delivery ports are ganged to a common outlet, final delivery being given through outlet No.2. Shims to a thickness of 0·035 ± 0·003 in. should be fitted under the piston heads in the micro pump units No.1 and 3, any adjustment to delivery being made to micro pump unit No. 2.

Testing

Calibration check

3. Connect the pump to a suitable test rig similar to fig 6 of the main chapter and fill the tank with oil DTD 900/4598 or DTD 900/4456. Set the back pressure to 50 lb/in² and check the delivery over a period of one minute. This should be 169 $^{+10}_{-0}$ cc/min.

4. To increase the pump delivery add shims under the piston head. To decrease delivery remove shims.

Note . . .

The calibration oil should be drained before the pump is put into service.

Insulation resistance

5. Remove the commutator end cover, disconnect the capacitor and earthed connection. Test the field coil insulation resistance using a a 250V insulation resistance tester. A reading of not less than 50000 ohms should be obtained.

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